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ABSTRACT

A study was conducted to determine the technical writing style that scientists prefer. The respondents--1089 scientists from agricultural experiment stations, 20 station editors, and 59 editors of scientific publications--completed a questionnaire requesting biographic information and reactions to a simplified style of writing and a difficult style, typical of that found in scientific journals. While most respondents indicated that they preferred the simplified style, they tended to think highly of scientists who write in the more complicated style. (Tables of findings accompany the text, and appendixes contain a list of the journals whose editors were surveyed and tables expanding the results according to presentation order of the writing samples.) (EL)

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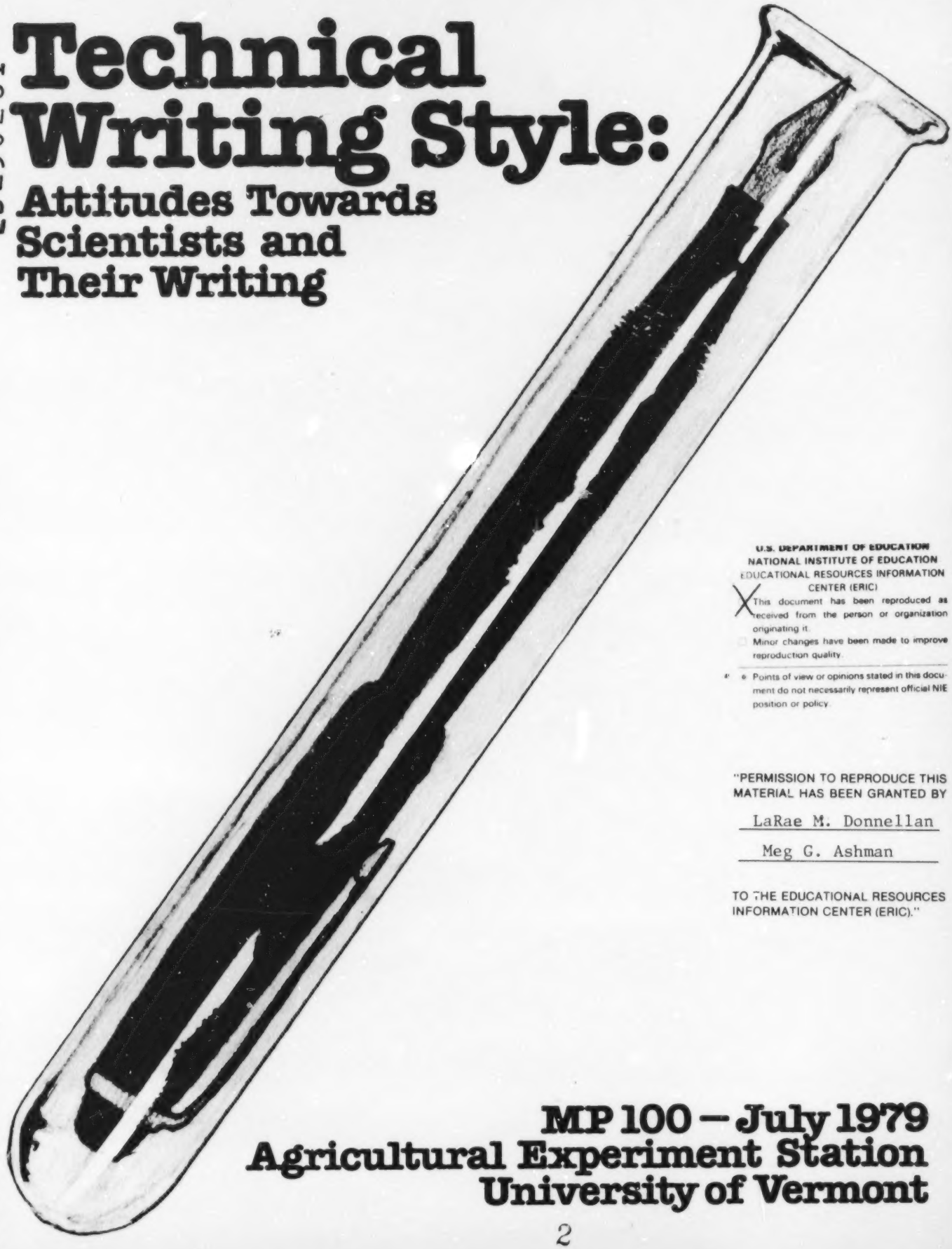
Technical Writing Style:

Attitudes Towards Scientists and Their Writing



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Summary

In 1978, we editors at the Vermont Agricultural Experiment Station conducted a study of technical writing style. We hoped to discover what style of writing is preferred today and how the choice of style influences readers' attitudes towards the authors. Our audiences were 1,645 scientists and 24 editors from 12 Northeast Experiment Stations, plus 69 journal editors from across North America.

Our questionnaire contained two parts. Part One consisted of biographic questions to determine such things as the respondents' training, specializations, and attitudes towards their work. A different, specific set of questions was directed towards each audience. Part Two contained two passages from similar articles on the hormonal basis of aggression in animals. One passage, supposedly written by a Mr. Smith, was of "standard reading ease," while the passage supposedly written by a Mr. Brown was "very difficult to read." After reading the two passages, respondents were then asked questions about the readability of the passages and their feelings of esteem for the two authors. To offset the influence of order of presentation, we had half of the questionnaires printed with the Brown version first and half with Smith first. Part Two was originally developed by Ewa Bardell of the Institute of Science and Technology at the University of Wales, Cardiff.

Our first hypothesis was that, given a choice, Station scientists would prefer to read manuscripts written in a style that is less complicated and more direct than what they frequently find in scientific journals. This proved to be the case. Sixty-six percent of all Northeast Station scientists preferred the Smith style. When we broke these responses down by order of presentation, we found that of those scientists who had read the complicated Brown passage first and found a difference between the passages, about 90% preferred the Smith style. Of those who read the Smith passage first, about 54% preferred the Smith style.

Our second hypothesis was that factors other than readability influence attitudes towards writing style and authors. When we looked at the responses as a whole, the results were ambiguous. But when we broke the responses down by order of presentation of the Brown-Smith passages, some interesting patterns arose.

Those who read the more complicated Brown version first selected the Smith version as being far more readable and held author Smith in much greater esteem than did the group as a whole or those who read the Smith version first. We assumed this was because the respondents had probably struggled through the more complicated Brown version and therefore were very receptive to the more simplified, edited Smith version.

Those who read the Smith version first also preferred it and, in general, rated it as being more readable than the Brown version. However, this group held author/scientist Brown in greater esteem than Smith. Obviously something other than readability influenced these results.

The Brown style resembles that frequently found in technical journals today and is considered appropriate by many in the academic and scientific communities. Those who read the less complicated Smith version first were somewhat familiar with the subject matter and therefore probably had less trouble with the Brown passage than did those who read it first. As a result, they probably looked more favorably upon author/scientist Brown who wrote in a style they are used to.

When we examined responses by Station, we discovered that almost all New Jersey scientists received the Brown-Smith version and almost all New York (Ithaca) scientists received the Smith-Brown version. As might be predicted, New Jersey scientists selected the Smith option most frequently and Ithaca scientists selected it least frequently. However, Vermont scientists, about half of whom had received the Brown-Smith version, were next to Ithaca in selecting the Smith option least frequently. Perhaps this means Vermont scientists tend to favor traditional technical writing style more than do other Station scientists in the Northeast.

Experiment Station editors can feel confident that they are giving the scientific community what it wants when they apply the same principles of readability to Station manuscripts that are used with Extension manuscripts (keeping in mind, of course, that the audiences are different). However, we must be sensitive to the fact that some scientists hold in high esteem authors who use a more traditional but less readable style of writing.

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Technical Writing Style: Attitudes Towards Scientists and Their Writing

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John Aleong[1]

Agricultural Experiment Station and Extension Service publications editors must be versatile. One day we may edit a manuscript on botulism followed by one on the winter hardiness of perennial plants. The next day it may be a brochure on a tax seminar or a pamphlet on feeding liquid whey to dairy cattle.

No one expects us to be specialists in dairy science, plant pathology, endocrinology, or any of the other subjects that Station or Extension authors write about. Our specialty is grammar and proper English usage.

Extension editors, and Station editors when we edit for the general public, are looked upon as the "typical" reader of the finished manuscript. In other words, if we can't understand what the author is trying to say, then chances are good that the general public won't understand either. This gives us leverage in making changes that will enhance the readability of the publication.

But what about when Station editors edit research reports or journal articles intended for the author's peers? Should we apply the principles of readability (short sentences, active voice, personal pronouns) that are used for Extension publications? Our communications training would lead us to say yes, that improved readability is desirable for all manuscripts. But occasionally we encounter a Station scientist who says that the scientific community will not accept anything other than the traditional, wordy, ponderous style found in most technical journals today.

Is this what the scientific community really wants? John Wilson, Jr., writing in Science, says yes (facetiously):

> Standard, accepted sci-tech gobbledygook is acceptable and expected. It's all that is wanted. Journal editors wouldn't accept, nor would the referees, a paper in plain English. It would be too long. It would not ring true. It wouldn't be bedaubed with the beloved, viscera-satisfying jargon.... It would sound—horrors!—like some of the simple-minded pieces in Physics Today or Scientific American. (1)

We decided to find out just what style of technical writing Station scientists prefer today. We suspected that, given a choice, they would prefer to read manu-

[1]Senior publications editor, publications editor, and statistician, respectively.

scripts written in a style that is less complicated and more direct than what they find in most scientific journals. Also, we suspected that factors other than readability (e.g. habit or impressions of competency) might influence attitudes towards writing style and authors.

We also wondered what our counterparts in the scientific community—the journal editors—think about technical writing style. We knew that most have not been trained as editors but as scientists (2); however, we suspected that they either have or soon develop a sense of what the proper style of writing should be for their journals. But would their attitudes more closely resemble those of scientists or those of Station editors?

So here was a natural set of audiences for our survey: Station editors, Station scientists, and journal editors.

Materials and Methods

We knew whom we wanted to survey but we had yet to find the right tool to get the information we sought. By chance we came across a questionnaire that fit our needs. The senior author of this paper met Dr. John Kirkman of the Institute of Science and Technology, University of Wales (Cardiff), in 1977. Dr. Kirkman is an international authority on technical writing style. In one study he found that engineers in Great Britain prefer by at least 3 to 1 a style of writing that consists of short sentences, active verbs, and personal pronouns (3). But he also found that many scientists were reluctant to use this style themselves for fear of losing esteem or credibility in the eyes of their peers.

Dr. Kirkman's assistant, Ewa Bardell, set out to determine whether these fears were justified (4). Through a review of relevant literature and personal interviews, she discovered that judgments of a communicator's credibility are based on perceptions of his or her:

- competence in the subject,
- trustworthiness,
- personal dynamism,
- objectivity,
- intentions towards the audience,
- personality,
- communicative ability, and
- appropriateness in choice of language and style.

With these items in mind, she developed a questionnaire that contained two passages about the same subject but in different styles; one was supposedly written by a Mr. Brown and the other by a Mr. Smith. She then asked the respondents questions that dealt with style preference

and the credibility factors discussed earlier.

So here was a questionnaire that tackled the two hypotheses we set out to study· that scientists would prefer to read a less complicated style of writing than is found in many journals, and that factors other than readability (such as credibility) affect style choice. Fortunately we received permission to use this questionnaire in the Northeast.

Procedure

We developed three separate sets of questionnaires, one for each audience. Part One of the questionnaires asked specific "biographic" questions of each audience; Part Two, which was the same for all three audiences, was the original Bardell questionnaire with the Smith-Brown passages and accompanying questions.

We solicited the participation of the Experiment Stations in the Northeast and 12 joined our study: Connecticut (Storrs), Delaware, Maine, Maryland, Massachusetts, New Jersey, New York (Geneva), New York (Ithaca), Pennsylvania, Rhode Island, Vermont, and West Virginia. In selecting journal editors, we identified the disciplines of Station scientists in the Northeast. Next, we queried Vermont scientists for the most prestigious journals in their fields, searched the library for other related journals, and selected 69 "representative" journals in the United States and Canada (see Appendix A).

Each Station chose a coordinator for this survey. We sent them our proposed questionnaire and asked that they and two scientists from their respective Stations review it and comment. For the journal editor set of questions, we asked Vermont Professor Richard Klein, the managing editor of Botanical Review, to check the phrasing and content. Then we evaluated the comments and revised the questionnaires.

To offset any influence that order of presentation might have, we had half of the questionnaires printed with the Brown passage first and the rest with the Smith passage first. However, we did not switch the order of the accompanying questions; in other words, the Brown passage or author Brown was always listed first as an option. And to aid in disseminating the questionnaires and compiling the results, we color-coded the questionnaires.

Survey coordinators determined the total number of editors and scientists at their Stations who would receive questionnaires. We sent the coordinators enough copies so that they could send out two mailings: one by January 9, 1978, and a second 2 weeks later (this followup was meant to urge those who had forgotten to respond to return their questionnaires).

The coordinators collected the questionnaires, maintaining the anonymity of the respondents, and returned the questionnaires to us. We surveyed the journal editors, who returned their questionnaires directly to us in self-addressed stamped envelopes.

The responses were keypunched and computerized. For most of the data, we simply counted responses and determined percentages. For selected variables, we formed contingency tables and performed chi square tests to determine the independence of the variables. For significant chi squares, we performed proportion separations.

The Questionaire Part One

In one of his studies, Kirkman (3) asked the respondents certain biographic questions such as age and job function to see if these factors influenced the responses. He found that managers, administrators, and senior engineers preferred a less complicated style of writing by an even greater margin (5 to 1) than did their subordinates.

We wondered whether the backgrounds of our audiences might influence their responses, so we developed our own set of questions for each audience.

Station scientist questions included the following:

- professorial rank or title,
- field of study,
- number of articles authored and published in refereed journals between January 1, 1975, and December 31, 1977.
- influences on technical writing style,
- self-evaluation of ability as a technical writer, and
- impression of the importance of technical writing to regular job.

Based on Kirkman's findings, we hypothesized that those authors with a rank of associate professor or above, those who frequently have articles published in refereed journals, and those who look upon themselves as above-average writers would prefer the less complicated style of writing to a greater degree than would authors with lower rank, who had been published less frequently, and who saw themselves as less-skilled writers.

With Station editors, we not only wanted to find out their backgrounds but to learn the editorial policy at their Stations. We asked the following questions:

- major field of study in college,
- percent of actual time, on the average, spent on Station work,
- policy regarding whether authors are required to submit manuscripts for refereed journals to Station editors before submitting them to the journals, and
- policy regarding number of manuscripts Station scientists must produce each year.

Our knowledge of journal editors was sketchy, so we asked them several questions about their backgrounds as well as questions about their jobs:

- subject matter of journal,
- major field of study in college,
- preparation for editing,
- years of experience as an editor,
- other jobs currently held, if any,
- image of self as primarily an editor, scientist, or both equally,
- number of manuscripts received and published each year,
- whether manuscripts receive peer review,
- perception of general quality of manuscripts received, and
- whether quality of a manuscript reflects more on the researcher, the institution, or both equally.

The Questionaire Part Two

We left this part of the questionnaire, which contained the Brown-Smith passages,

essentially as Bardell wrote it. To simplify the keypunching task, however, we slightly changed the phrasing of the questions.

Here are the two passages supposedly from the middle of similar articles on the hormonal basis of aggression in animals.

Brown's version

In the first experiment of the series using mice it was discovered that total removal of the adrenal glands effects reduction of aggressiveness and that aggressiveness in adrenalectomised mice is restorable to the level of intact mice by treatment with corticosterone. These results point to the indispensability of the adrenals for the full expression of aggression. Nevertheless, since adrenalectomy is followed by an increase in the release of adrenocorticotrophic hormone (ACTH), and since ACTH has been reported (P. Brain, 1972) to decrease the aggressiveness of intact mice, it is possible that the effects of adrenalectomy on aggressiveness are a function of the concurrent increased levels of ACTH. However, high levels of ACTH, in addition to causing increases in glucocorticoids (which possibly accounts for the depression of aggression in intact mice by ACTH), also result in decreased androgen levels. In view of the fact that animals with low androgen levels are characterised by decreased aggressiveness the possibility exists that adrenalectomy, rather than affecting aggression directly, has the effect of reducing aggressiveness by producing an ACTH-mediated condition of decreased androgen levels.

Smith's version

The first experiment in our series with mice showed that total removal of the adrenal glands reduces aggressiveness. Moreover, when treated with corticosterone, mice that had their adrenals taken out became as aggressive as intact animals again. These findings suggest that the adrenals are necessary for animals to show full aggressiveness.

But removal of the adrenals raises the levels of adrenocorticotrophic hormone (ACTH), and P. Brain (2) found that ACTH lowers the aggresiveness of intact mice. Thus the reduction of aggressiveness after this operation might be due to the higher levels of ACTH which accompany it.

However, high levels of ACTH have two effects. First, the levels of glucocorticoids rise, which might accoun for P. Brain's results. Second, the levels of androgen fall. Since animals with low levels of androgen are less aggressive, it is possible that removal of the adrenals reduces aggressiveness only indirectly: by raising the levels of ACTH it causes androgen levels to drop.

Although you might object to parts of both passages, they do represent different approaches to technical writing (see Table 1).

Table 1. Differences in phrasing and sentence length between the Brown and Smith passages.

Item	Brown	Smith
Average sentence length (words)	36	17
No. of paragraphs	1	3
No. of active-verb phrases	3	12
No. of passive-verb phrases	9	4
No. of prepositions	37	21

5

Word and sentence length generally are good predictors of readability (5). The Brown passage, with an average sentence length of 36 words, is categorized as very difficult reading (6, 7, 8, 9). On the other hand, the Smith passage, with an average sentence length of 17 words, is of standard difficulty, suitable for a high school-trained audience. Professional writers' sentences average in the low 20's (6, 10); while neither passage is at this level, the Smith version is much closer.

Respondents were asked questions about the readability and appropriateness of the two styles. And then, following Bardell's lead, we asked questions about the two authors' credibility and worthiness of esteem (see Fig. 1).

1. Do you, personally, prefer to read scientific articles written in a style similar to that of: Brown, or Smith, or no discernible difference?
2. Which of these styles do you think is more appropriate for scientific writing?
3. Which of these two versions do you think is more interesting to read?
4. Which version do you think is more precise?
5. Which version do you think explains things better?
6. Which version do you think is more difficult to read?
7. Which author gives you the impression of being more competent as a scientist?
8. Which author communicates his thoughts to you more successfully?
9. Which author inspires you with more confidence in what he says?
10. Which author do you sense has a more dynamic personality?
11. Which author appears to have more consideration for his readers?
12. Which author seems to have a better-organized mind?
13. Which author do you personally find more stimulating?
14. Which author seems to be more objective?

Figure 1. Questions from Part Two of the questionnaire.

Results and Discussion

Response Rates

Two-thirds of those who received the questionnaire responded, ranging from 66% of the Station scientists to 83% of the Station editors and 86% of the journal editors (Table 2). For the Station scientist survey, Massachusetts recorded the highest response rate of 92% while New York (Ithaca) recorded the lowest rate of 41% (Table 3).

Table 2. Responses of the three audiences.

Audience	No. sent	No. responding	% responding
Station scientists	1,645	1,089	66.1
Station editors	24	20	83.3
Journal editors	69	59	85.5
TOTAL	1,738	1,168	67.2

Table 3. Responses of Station scientists, broken down by state.

State	No. sent	No. responding	% responding
Massachusetts	95	87	91.6
New York (Geneva)	67	60	89.6
Delaware	47	40	85.1
Vermont	57	47	82.4
Pennsylvania	236	182	77.1
West Virginia	100	77	77.0
Maine	165	119	72.1
Rhode Island	61	44	72.1
Maryland	126	84	66.7
New Jersey	190	111	58.4
Connecticut (Storrs)	85	49	57.6
New York (Ithaca)	460	188	40.9
TOTAL	1,645	1,088*	66.1

*One response did not have a Station designation; thus, the actual total is 1,089.

Audience Profiles

Station Scientists

Of the 1,089 Station scientists who responded, 92% were males. Nearly 75% were associate or full professors. Slightly more than a quarter listed plant and soil science as their discipline; the next highest groups were animal sciences and microbiology and biochemistry. The respondents were evenly distributed in the amount of time (up to 25%, 50%, 75%, or 100%) that they spent on Station work.

Nearly 44% had published fewer than one article per year in a refereed journal between January 1, 1975, and December 31, 1977. On the other hand, about 10% had published more than three articles in such journals during that time.

The majority (58%) rated themselves as "above average" in writing ability; another 9% rated themselves as "excellent." Only half of a percent rated themselves as "poor."

After performing a two-factor analysis, we found that rank, frequency of publication, and self-evaluation of writing ability did not significantly influence responses to the questionnaire. This seems to contradict Kirkman's findings (3).

Table 4 shows how influential certain items have been on the way Station scientists write today; nearly 83% rated what they learned from looking at scientific journals as being very influential or influential. This item is particularly important when you consider that the style of writing frequently found in technical journals today resembles that of the Brown passage (lengthy, passive voice, jargon).

Nearly three-fourths of the scientists considered technical writing to be absolutely important to the performance of their jobs. One-fourth considered it somewhat important, and the remainder considered it of little or no importance.

Table 4. What most influenced the writing style of Station scientists?

Item	% rating as very influential or influential
Looking at scientific journals	82.6
Taking English composition	67.6
Interacting with thesis adviser	61.0
Doing what seems right	52.6
Taking science classes	42.8
Working with a technical editor	34.7
Taking technical writing course	24.1
Other (includes peer review)	12.8

Table 5. What best prepared journal editors for becoming editors?

Item	% rating as very influential or influential
Knowledge of subject matter	86.4
Writing journal articles	76.3
Reviewing journal manuscripts	55.9
College training in writing	42.4
Editing another publication (not a journal)	40.7
Experience on journal editorial board	40.6
Editing another journal	25.4
Other (includes precollege writing training and newspaper-radio experience)	25.4
College training in editing	6.8

Station Editors

Of the 20 Station editors who responded, half were male. Eight majored in journalism or agricultural journalism and another four majored in English. The others majored in such areas as home economics, humanities, graphic design, or biology. Twelve spent less than half of their time on Station work; only one editor worked exclusively for the Station.

Three Station editors answered that Station scientists were required to send their journal article manuscripts to the Station editors—either for a journal article number or for the number and editing—before they send them to the journals. However, several editors indicated that the manuscripts receive some form of internal review before they are sent to the journals. Apparently no Station requires its scientists to publish a certain number of manuscripts each year, although two editors indicated that promotion depends heavily on the number and quality of scientific papers published.

Journal Editors

Of the 59 journal editors who responded to our questionnaire, 52 were male. Thirty-three editors had majored in engineering or in the natural or physical sciences, another 15 majored in communications or the humanities, and the remainder graduated with joint or miscellaneous majors.

Unlike Station editors, nearly 58% of the journal editors also held a full-time job; another 10% held a part-time job. Slightly more than a quarter of the respondents worked only as the editors of their respective journals. Also, 56% of the respondents considered themselves to be primarily scientists; 22% considered themselves to be primarily editors; and another 10% considered themselves to be both equally. And, nearly half of the respondents had been journal editors for 5 years or less.

Three-quarters of the journal editors reported that they send manuscripts out for peer review. The number of manu-

scripts they receive each year ranged from 28 to 4,000. The percent published, however, ranged from 7% (50 of 700 submitted) to 88% (175 of 200 submitted), with the mean at 50%.

Table 5 lists what items the journal editors considered best prepared them to become editors.

Impressions of Writing Ability

We asked journal editors what they think of the quality of manuscripts that they receive. We also asked Station scientists how they would rate themselves as writers (Table 6).

Table 6. Quality of manuscripts received by journals compared with Station scientists' self-evaluation of writing ability.*

Journal editors' rating of general level of mss. received		Station scientists' rating of their ability as writers
14%	Excellent	9%
15	Above average	58
32	Average	27
29	Below average	4
2	Poor	0.5

*Totals do not add up to 100% because not everyone responded.

Only 29% of the journal editors felt that the general level of the manuscripts they receive is "excellent" or "above average." However, 67% of the Station scientists rated themselves as "excellent" or "above average" writers. Although these figures are not directly related, perhaps they indicate that authors of scientific manuscripts may not write as well as they think they do, or that journal editors and Station scientists have different standards for writing quality.

About 61% (or 36) of the journal editors replied that the quality of a manuscript reflects more on the researcher than on the institution; however, about 27% (or 16) of the journal editors said that the quality of the manuscripts reflects equally on the researcher and his or her institution.

Responses to Part Two—All Data

About 67% of all respondents preferred the Smith (or less complicated) version, about 28% preferred the Brown version, and about 5% found no discernible difference between the two passages (Table 7). Station editors preferred the less complicated, more direct Smith version by the largest margin, followed by journal editors and Station scientists. Almost all of the responses to questions followed this preference pattern. But because Station scientists represent more than 93% of all respondents, the totals we quote essentially are those of the scientists.

Similarly, all three groups of respondents felt that the Smith version is easier and more interesting to read and that it explains things better (Table 8). These results correspond to those that Bardell (4) received when she surveyed nearly 400 scientists employed in both academic and industrial establishments in Great Britain. She found that 54% of her sample felt that the Smith style is more appropriate for scientific writing; 55% of our respondents felt this way.

Table 7. Which style is preferred for technical writing?*

Answer	All	Station scientists	Station editors	Journal editors
Total No.--	(1,168)	(1,089)	(20)	(59)
Brown version	27.6%	28.5%	0 %	20.3%
Smith version	66.5	65.9	90.0	69.5
No discernible difference	4.9	5.0	5.0	5.1
No answer	1.0	.6	5.0	5.1
TOTAL	100.0	100.0	100.0	100.0

*Percentages are extremely highly significant ($p << .001$).

Table 8. Respondents' judgments of readability and appropriateness of style.

	Brown version	Smith version	No discernible difference	No answer
	- - - - - - - - - - - - % - - - - - - - - - - - - - - - - - -			
More appropriate style for scientific writing*	32.1	55.0	11.5	1.4
More interesting to read*	24.1	64.1	10.5	1.3
More precise+	30.2	33.5	35.2	1.1
More explanatory*	27.6	54.5	16.5	1.4
More difficult to read*	73.3	17.9	8.0	.8

*Percentages are extremely highly significant ($p << .001$).
+Percentages are not significant.

However, only 18% of her group felt that the Brown style is more appropriate while 32% of our group felt this way. Similarly, we noticed a difference regarding precision of style. Fifty-six percent of the respondents in her study felt that neither style is more precise than the other. Of those who found a difference between the two passages, twice as many felt that the Smith style is more precise. However, we found in our study that approximately the same number of respondents selected the Smith version or the Brown version or found no discernible difference.

Our results parallel those of Bardell in that most respondents felt that Smith communicates his thoughts more successfully, has more consideration for his readers, has a better-organized mind, and is more stimulating (Table 9). Similarly, the majority of both sets of respondents found no discernible difference in the objectivity of the two authors. However, of those who found a difference between the two authors, the majority felt Smith was more objective.

Whereas the greatest number of respondents in Bardell's study found no difference between Brown and Smith in terms of inspiring more confidence and having a more dynamic personality, the greatest number of respondents in our study selected Smith for these two categories.

Table 9. Respondents' judgments of credibility and worthiness of esteem.

	Brown	Smith	No discernible difference	No answer
			%	
Is a more competent scientist*	32.5	25.9	40.2	1.4
Communicates his thoughts more successfully+	26.5	64.0	8.5	1.0
Inspires more confidence‡	30.6	36.6	31.7	1.1
Has a more dynamic personality+	25.2	45.5	27.1	2.2
Has more consideration for readers+	16.4	66.6	15.3	1.7
Has a better-organized mind+	25.7	47.8	25.1	1.4
Is more stimulating+	24.5	55.6	18.4	1.5
Is more objective*	21.6	28.8	48.3	1.3

*Brown-Smith percentages are very highly significant ($p < .005$).
+Brown-Smith percentages are extremely highly significant ($p \ll .001$).
‡Brown-Smith percentages are significant ($p < .025$).

For the question of which author appears more competent as a scientist, the highest percentage of respondents in both studies saw no difference between Brown or Smith. As might be expected from the pattern of responses to the other questions, the respondents in Bardell's study, when they found a difference, more often felt that Smith was more competent than Brown.

But here our respondents broke the pattern. This was the only time that author Brown or the Brown passage received a more favorable rating (33 to 26%) than author Smith or the Smith passage (however, 40% found no discernible difference between the competency of the two scientists).

When we consider that only about 28% of our respondents said that they preferred the Brown style over the Smith style (Table 7), it's obvious that at least some of the respondents associate scientific competency with long sentences and passive phrasing even though they may prefer a style of writing similar to Smith's.

Responses to Part Two—By Order of Presentation

We had suspected that order of presentation might influence responses; this turned out to be the case. Bardell argues that whichever version appears second is bound to be slightly easier to understand than it would be if read on its own, because of the readers' familiarity with the topic acquired by reading the first version (4). However, we surmise that something more influences the responses.

The Brown passage resembles a style of writing frequently found in scientific journals today. As a result, one might assume that this would be the style that the scientific community would prefer. However, as we pointed out earlier, 67% of the total group, regardless of which version they read first, preferred Smith; nearly

Table 10. Order of presentation as it influences style preference of all respondents who found a difference between the two passages.

Preference	Read Brown first*		Read Smith first+		Total
Brown version	45	9.2%	277	46.0%	322
Smith version	446	90.8%	331	54.0%	777
TOTAL	491	100.0%	608	100.0%	1,099

*Percentages are extremely highly significant ($p << .001$).
+Percentages are not significant.

28% preferred Brown. Of this 28% nearly 9 out of 10 had read the Smith version first. In other words, these respondents had read the less difficultly phrased version and were somewhat familiar with the subject matter before they read the more complicated version.

We can look at our data in another way. Table 10 lists only those respondents who preferred either Smith or Brown. When the respondents read the Brown version first, the vast majority (90.8%) preferred the less complicated Smith version. This appears to indicate that when given an alternative to the verbose style they probably are used to, these respondents were highly receptive to a less complicated style.

Interestingly enough, the greatest proportion of those respondents who read the less complicated version first also preferred it, although by not as great a margin (Table 10). And regardless of which version was read first, the majority of all respondents felt that the Smith version was more interesting to read, that the Brown version was more difficult to read, and that Smith had more consideration for his readers.

However, we began to notice some differences when we examined responses to the remaining questions.

Brown First

For each of the 14 questions, when the Brown version was read first, Smith was chosen by a significantly greater proportion ($p < .01$) of all respondents and by the subgroup of Station scientists (Tables 11 and 12). Journal editors and Station editors followed this pattern, too, except that an equal number of Station editors selected Smith and Brown as the more competent scientist (however, an even greater number found no discernible difference). Surprisingly enough in light of their communications backgrounds, Station editors who had read Brown first were more likely than Station scientists or journal editors to find no discernible difference between Brown or Smith for certain questions. This may have been caused by small sample size ($S = 9$).

Smith First

When we looked at the responses of those people who read the Smith version first, the differences were much more obvious. As we pointed out earlier, the greatest proportion of these respondents preferred the Smith passage (this was true of the subgroup of Station scientists as well). They also found it more interesting and less difficult to read than the Brown passage and felt that author Smith communicates his thoughts more successfully, has a more dynamic personality, is more considerate of his readers, and is more stimulating than author Brown.

On the other hand, the greatest proportion of the total group and of Station scientists who read Smith first felt that the Brown version is more appropriate for scientific writing, is more precise, and explains things better. They also felt that author Brown appears more competent as a scientist, inspires more confidence in what he says, has a better organized mind, and is more objective (Tables 11 and 12; for more detail, see Appendix Tables B1 and B2).

Table 11. Influence of order of presentation on judgments of those respondents who chose the Brown or Smith passage as more readable and in a more appropriate style.

Brown first

	All respondents		Station scientists		Station editors		Journal editors	
	Brown	Smith	Brown	Smith	Brown	Smith	Brown	Smith
Preferred style	-	**	-	**	-	**	-	**
Appropriate style	-	**	-	**	-	N	-	**
Interesting style	-	**	-	**	-	**	-	**
Precise style	-	**	-	**	N	N	-	**
Better explained	-	**	-	**	-	*	-	**
Less difficult to read+	-	**	-	**	-	**	-	**

Smith first

	All respondents		Station scientists		Station editors		Journal editors	
	Brown	Smith	Brown	Smith	Brown	Smith	Brown	Smith
Preferred style	-	*	-	N	-	**	-	*
Appropriate style	N	-	*	-	-	**	-	N
Interesting style	-	**	-	**	-	**	-	**
Precise style	**	-	**	-	-	N	N	N
Better explained	N	-	N	-	-	*	-	**
Less difficult to read+	-	**	-	**	-	**	-	**

** = Significant at $p < .01$.

* = Significant at $p < .05$.

N = Numerically preferred, but not statistically significant. When N appears for both Brown and Smith, this means that Brown and Smith were chosen by the same number of respondents; however, an even greater percentage found no discernible difference.

+ = Scores translated from the question, "Which version do you think is more difficult to read?"

Table 12. Influence of order of presentation on judgments of those respondents who chose Brown or Smith as more credible and worthy of esteem.

Brown first

	All respondents		Station scientists		Station editors		Journal editors	
	Brown	Smith	Brown	Smith	Brown	Smith	Brown	Smith
Competent scientist	-	**	-	**	N	N	-	**
Successful communicator	-	**	-	**	-	**	-	**
Confidence inspiring	-	**	-	**	-	N	-	*
Dynamic personality	-	**	-	**	-	**	-	**
Consideration for readers	-	**	-	**	-	**	-	**
Better-organized mind	-	**	-	**	-	N	-	**
Stimulating author	-	**	-	**	-	**	-	**
Objective author	-	**	-	**	-	N	-	N

Smith first

	All respondents		Station scientists		Station editors		Journal editors	
	Brown	Smith	Brown	Smith	Brown	Smith	Brown	Smith
Competent scientist	**	-	**	-	-	N	N	-
Successful communicator	-	*	-	N	-	**	-	**
Confidence inspiring	**	-	**	-	-	*	-	N
Dynamic personality	-	N	-	N	-	*	-	N
Consideration for readers	-	**	-	**	-	**	-	**
Better-organized mind	**	-	**	-	-	**	-	**
Stimulating author	-	N	-	N	-	**	-	**
Objective author	**	-	**	-	-	N	-	N

** = Significant at $p < .01$.

* = Significant at $p < .05$.

N = Numerically preferred, but not statistically significant. When N appears for both Brown and Smith, this means that Brown and Smith were chosen by the same number of respondents; however, an even greater percentage found no discernible difference.

In other words, even though these respondents prefer articles in the Smith style (because they are more readable), they think highly of scientists who write in the Brown style. As a result, they might choose to write in the Brown style so as to be looked upon favorably by their peers.

Unlike Station scientists, the greatest proportion of both groups of editors who had read Smith first selected the Smith option, with two exceptions. A greater proportion of these journal editors found no discernible difference between the precision of the two authors and felt that Brown appeared more competent as a scientist.

Breakdown by State

A serendipitous occurrence allowed us to see what might happen if all members of a group of respondents read one version first. Each Station coordinator was supposed to have distributed an equal number of Brown-Smith and Smith-Brown questionnaires to scientists at their Station. However, of the 111 questionnaires returned from New Jersey, all but one were the Brown-Smith version; of the 188 questionnaires returned from New York (Ithaca), all but three were the Smith-Brown version. As you might predict from the previous discussion on order of presentation, New Jersey scientists preferred the Smith style by the

Table 13. Stations* that selected Brown or Smith by the highest or lowest percentage for each of 14 questions.

	Percentage of votes			
	Brown		Smith	
Question	Highest	Lowest	Highest	Lowest
1. Preferred style	IT[v]	NJ	NJ	IT[v]
2. Appropriate style	VT[i]	NJ	NJ	IT[v]
3. Interesting style	IT	NJ	NJ	IT[v]
4. Precise style	CT[v]	NJ	NJ	VT[i]
5. Better explained	VT[i]	NJ	NJ	IT[v]
6. Less difficult to read+	IT[v]	NJ	NJ	IT[v]
7. Competent scientist	VT	NJ	NJ	IT[v]
8. Successful communicator	IT/WV	NJ	NJ	IT
9. Confidence inspiring	VT	NJ	NJ	IT
10. Dynamic personality	CT	NJ	MA[n]	IT
11. Consideration for readers	IT	NJ	NJ	IT
12. Better-organized mind	IT	NJ	NJ	IT
13. Stimulating author	VT[i]	NJ	NJ	IT[v]
14. Objective author	VT	NJ	NJ	IT

*Station codes: IT = New York (Ithaca); NJ = New Jersey; VT = Vermont; CT = Connecticut (Storrs); WV = West Virginia; MA = Massachusetts.

v = Vermont in second place.

i = New York (Ithaca) in second place.

n = New Jersey in second place.

+Scores translated from the question, "Which version do you think is more difficult to read?"

greatest margin and Ithaca scientists preferred it by the least margin.

Table 13 indicates which Station selected Brown or Smith by the greatest or lowest percentage for all 14 questions. Any one Station could represent 28 extremes (e.g. preferring Smith style most and Brown style least represent two extremes). As might be expected, New Jersey scientists gave Brown the lowest ranking in 14 of 14 cases; they also gave Smith the highest ranking in 13 of 14 cases (they came in second in that one odd case). Similarly, Ithaca scientists gave Smith the lowest ranking in 13 of 14 cases and gave Brown the highest ranking in 6 of 14 cases (they came in second in four cases).

In other words, order of presentation probably influenced the selections of these scientists. But interestingly enough, Ithaca scientists did not favor Brown nearly as much as did the entire group who had read the Smith passage first.

We discovered that Vermont scientists (about half of whom had received the Brown-Smith version) selected Brown far more than you would have predicted: they ranked Brown highest in six of 14 cases (they came in second three times) and ranked Smith lowest once and came in next to lowest six times. This leads us to assume that Vermont scientists tend to favor traditional technical writing style more than do other Station scientists in the Northeast.

Conclusions and Recommendations

Our first hypothesis was that, given a choice, Station scientists would prefer to read manuscripts written in a style that is simpler and more direct than what is frequently found in scientific journals. This proved to be the case. In looking at all Northeast Station scientists, we found that 66% preferred the Smith style. When we broke these responses down by order of presentation, we found that of those scientists who had read the Brown passage first and had found a difference between the passages, about 90% preferred the Smith style. Of those who read the Smith passage first, about 54% preferred the Smith style.

Second, we assumed that factors other than readability influence attitudes towards writing style and authors. Order of presentation proved to have an unexpectedly strong influence on the results, particularly when the Brown passage appeared first. And when we examined the responses of those who read the Smith passage first, we found that even though the greatest proportion found the Smith passage, in general, more readable, they held author Brown in higher esteem.

So what exactly influenced the choices made by the three audiences in our study? Perhaps it might be nothing more than the subject matter of the passages: the hormonal basis of aggression in animals. Perhaps if respondents were not familiar with the subject, they might have preferred the less complicated Smith style. A future

study might direct a Brown-Smith-type questionnaire only towards an audience familiar with the subject matter.

A second possible influence on selection might be simply which version the respondents read second, as suggested by Bardell (4). However, we found that the greatest proportion of those who read the more complicated Brown version second felt the Smith version was more readable.

A related factor might be mneme, or the influence of past experience (11). In other words, if respondents were used to using or seeing the Brown style of writing in scientific journals, then you would assume that they would tend to select the Brown option on the questionnaire. This does not seem to be the case, especially for those who read the Brown passage first and yet chose the Smith option by large margins.

One strong influence on choice had to be the respondents' feelings about technical writing style. We structured our questionnaire around style and drew the respondents' attention to this item. Readability experts (6, 7, 8, 9) rate the Brown style as very difficult reading. When respondents read the Brown passage first, they were highly receptive to a simplified, less complicated (i.e. edited) style of writing. Simplified style does not mean simple-minded style. The Smith passage discusses the same topic as the Brown version and carries such technical terms as adrenocorticotrophic hormone, glucocorticoids, and androgen levels. The difference is that the Smith version uses active voice, personal pronouns, and short sentences.

Experiment Station editors can feel confident that they are indeed giving the scientific community what it wants when they urge Station scientists to use the same principles of readability that are applied to Extension publications. The approach to writing can be the same—to be understood; but the audiences, with their different technical backgrounds, must be kept in mind. Why should busy scientists be forced to struggle through difficult passages when they prefer to read less complicated phrasing?

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Appendixes

A. Journals Surveyed

- Adult Education
- Agricultural Engineering
- Agronomy Journal
- American Dyestuff Reporter
- American Educational Research Journal
- American Forests
- American Institute of Planners Journal
- American Journal of Agricultural Economics
- American Journal of Botany
- American Journal of Clinical Nutrition
- American Journal of Physiology
- American Journal of Sociology
- American Journal of Veterinary Research
- American Sociological Review
- American Sociologist
- American Statistical Association Journal
- American Statistician
- American Vocational Journal
- Analytical Biochemistry
- Analytical Chemistry
- Applied and Environmental Microbiology
- Biochemistry
- Biology of Reproduction
- BioScience
- Canadian Agricultural Engineering
- Canadian Entomologist
- Canadian Journal of Botany
- Canadian Journal of Forest Research
- Canadian Journal of Plant Science
- Cornell Veterinarian
- Crop Science
- Cultured Dairy Products Journal
- Economic Geography
- Endocrinology
- Entomological Society of America--Annals
- Environmental Entomology
- Forest Industries
- Forest Products Journal
- Home Economics Research Journal
- HortScience
- Journal of Animal Science
- Journal of Consumer Affairs
- Journal of Dairy Science
- Journal of Economic Entomology
- Journal of Environmental Quality
- Journal of Food Protection
- Journal of Forestry
- Journal of Nutrition
- Journal of Physical Oceanography
- Journal of Protozoology
- Maritime Sediments
- Mycologia
- Northern Logger
- Oceans
- Phylogia
- Plant Physiology
- Pollution Engineering
- Poultry Science
- Quarterly Journal of Economics
- Quarterly Review of Botany
- Science
- Sociological Quarterly
- Soil Science
- Technometrics
- Tissue and Cell
- Transactions of the American Society of Agricultural Engineers
- Underwater Naturalist
- Veterinary Medicine Small Animal Clinician
- Water Resources Bulletin

B. Expanded Order of Presentation Tables

Table B1. Influence of order of presentation on judgments of those respondents who chose the Brown or Smith passage as more readable and in a more appropriate style.

Brown first

	All respondents		Station scientists		Station editors		Journal editors	
	Brown	Smith	Brown	Smith	Brown	Smith	Brown	Smith
Preferred style	8.7	86.4**	8.5	86.9**	0	88.9**	15.4	76.9**
Appropriate style	14.5	72.9**	14.6	73.4**	22.2	66.7[n]	11.5	65.4**
Interesting style	8.9	82.6**	8.9	82.5**	0	88.9**	11.5	80.8**
Precise style	19.6	46.3**	20.0	46.4**	22.2[n]	22.2[n]	11.5	53.8**
Better explained	12.6	73.8**	12.5	74.0**	11.1	77.8*	15.4	69.2**
Less difficult to read+	3.7	91.7**	3.5	91.9**	0	100.00**	7.7	84.6**

Smith first

	All respondents		Station scientists		Station editors		Journal editors	
	Brown	Smith	Brown	Smith	Brown	Smith	Brown	Smith
Preferred style	42.8[n]	51.2*	44.4	49.5[n]	0	100.0**	25.8	67.7*
Appropriate style	46.4[n]	41.1	47.5*	39.4	0	90.0**	38.7	58.1[n]
Interesting style	36.3	49.9**	38.0	48.0**	0	100.0**	16.1	71.0**
Precise style	38.9**	23.5	39.6**	22.8	20.0	40.0[n]	32.3[n]	32.3[n]
Better explained	39.7[n]	39.6	41.4[n]	38.0	10.0	20.0*	16.1	61.3**
Less difficult to read+	29.4	59.2**	30.5	57.4**	10.0	90.0**	16.1	83.9**

** = Significant at $p < .01$.

* = Significant at $p < .05$.

n = Numerically preferred but not statistically significant. When n appears for both Brown and Smith, this means that Brown and Smith were chosen by the same number of respondents; however, an even greater percentage found no discernible difference.

+ = Scores translated from the question, "Which version do you think is more difficult to read?"

Table B2. Influence of order of presentation on judgments of those respondents who chose Brown or Smith as more credible and worthy of esteem.

Brown first

	All respondents		Station scientists		Station editors		Journal editors	
	Brown	Smith	Brown	Smith	Brown	Smith	Brown	Smith
Competent scientist	18.2	37.0**	18.9	37.2**	22.2[n]	22.2[n]	3.8	38.5**
Successful communicator	9.7	83.7**	9.8	83.6**	0	100.0**	11.5	80.8**
Confidence inspiring	13.0	52.5**	13.1	53.0**	11.1	44.4[n]	11.5	46.2*
Dynamic personality	14.9	57.4**	15.4	57.2**	0	77.8**	11.5	53.8**
Consideration for readers	2.9	83.7**	2.9	83.8**	0	77.8**	3.8	84.6**
Better-organized mind	8.9	69.6**	8.7	70.5**	11.1	55.6[n]	11.5	57.7**
Stimulating author	9.1	73.6**	8.9	73.2**	0	100.0**	15.4	73.1**
Objective author	12.2	41.9**	11.6	42.2**	11.1	22.2[n]	23.1	42.3[n]

Smith first

	All respondents		Station scientists		Station editors		Journal editors	
	Brown	Smith	Brown	Smith	Brown	Smith	Brown	Smith
Competent scientist	44.2**	17.3	45.7**	16.7	0	30.0[n]	29.0[n]	25.8
Successful communicator	40.2	48.7*	42.2	47.0[n]	0	80.0**	12.9	71.0**
Confidence inspiring	45.0**	24.1	46.5**	22.9	0	60.0*	29.0	35.5[n]
Dynamic personality	33.5	36.3[n]	34.5	35.6[n]	0	50.0*	25.8	45.2[n]
Consideration for readers	27.4	53.5**	28.7	52.1**	0	90.0**	9.7	67.7**
Better-organized mind	39.3**	30.8	41.3**	28.9	0	80.0**	12.9	51.6**
Stimulating author	36.9	41.7[n]	38.6	40.4[n]	0	80.0**	16.1	54.8*
Objective author	29.4**	18.5	30.5**	18.5	0	20.0[n]	16.1	19.4[n]

** = Significant at $p < .01$.

* = Significant at $p < .05$.

n = Numerically preferred but not statistically significant. When n appears for both Brown and Smith, this means that Brown and Smith were chosen by the same number of respondents; however, an even greater persentage found no discernible difference.